City of Hillsboro

Presented by: NEF May 26, 2017

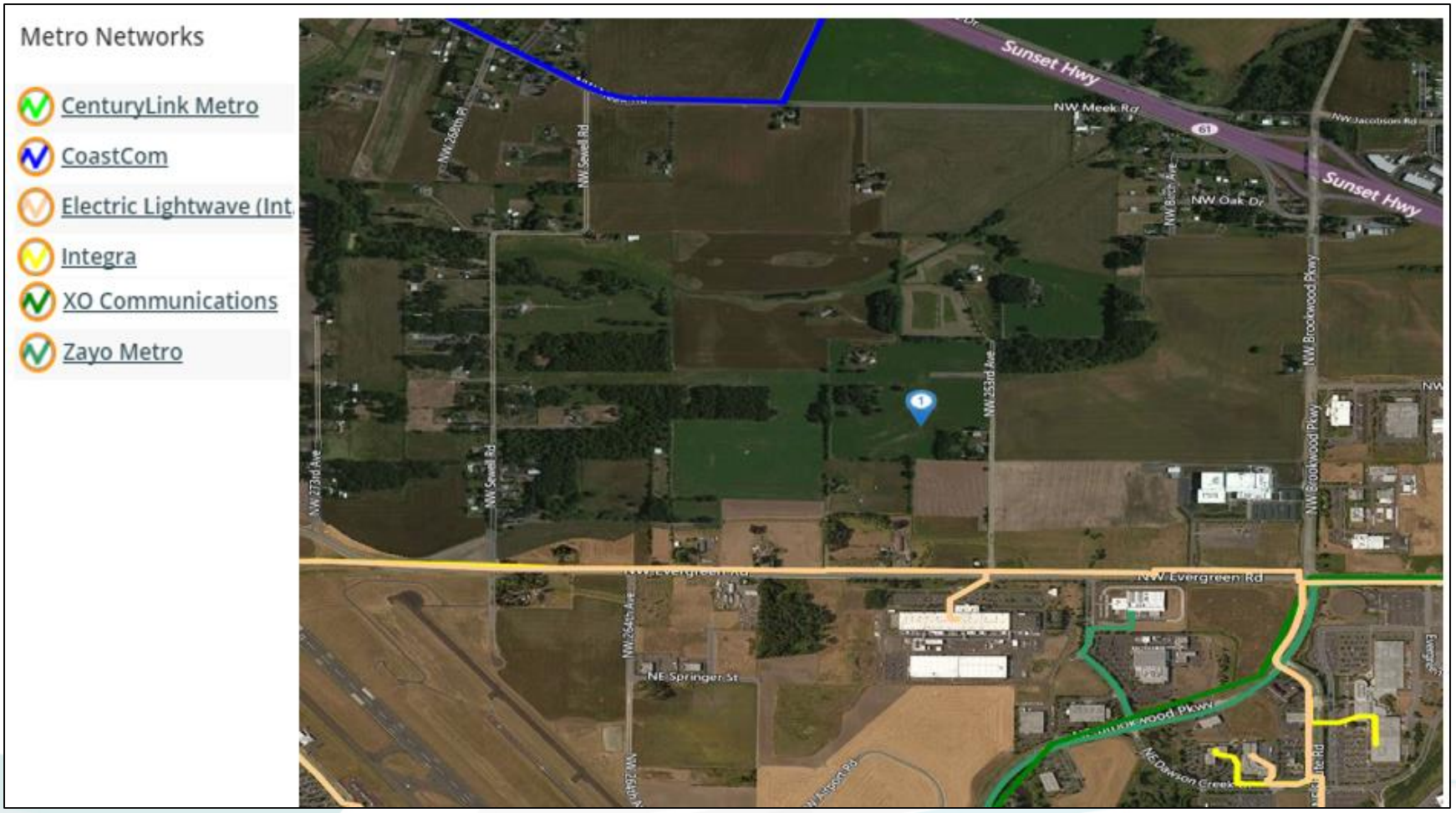
Report Background

NEF is professional services firm that provides research, analysis, consulting and planning for large infrastructure projects, such as fiber optic network deployments, municipal conduit systems, data center site selection and more. The information in this report is based upon data obtained from a wide variety of sources, including, but not limited to: service providers, in-house resources, historical records, interviews with subject matter experts and facility owners/operators.

For the network portion of the report, NEF focused primarily on facilities-based providers. Facilities-based service providers are those that own and operate their own fiber network. Some service providers routinely lease fiber from other service providers; others lease fiber when they are out of their own operating area. Of the facilities-based service providers, some will lease dark fiber to other service providers or end users, while others only sell telecommunications or "lit" services. The telecommunications industry is evolving quickly and the best source for information about what the service providers are currently selling will always be from the service providers directly. Likewise, metro networks are constantly expanding, and new buildings are being lit by service providers every day.

NEF's team of analysts strives to be accurate and thorough in the research and creation of this report; and while reasonable care has been taken in the preparation of this report, there is the possibility of errors and omissions in facts, figures or material. Information, statistics and data from a wide span of time has been included for the directional and historical value it represents. The intent of this report is to provide data and analysis that would be valuable in the data center site selection process and is not meant to take the place of any due diligence, specific investigational work or similar fact-finding endeavors.

NW Evergreen Road and West of NE 41st



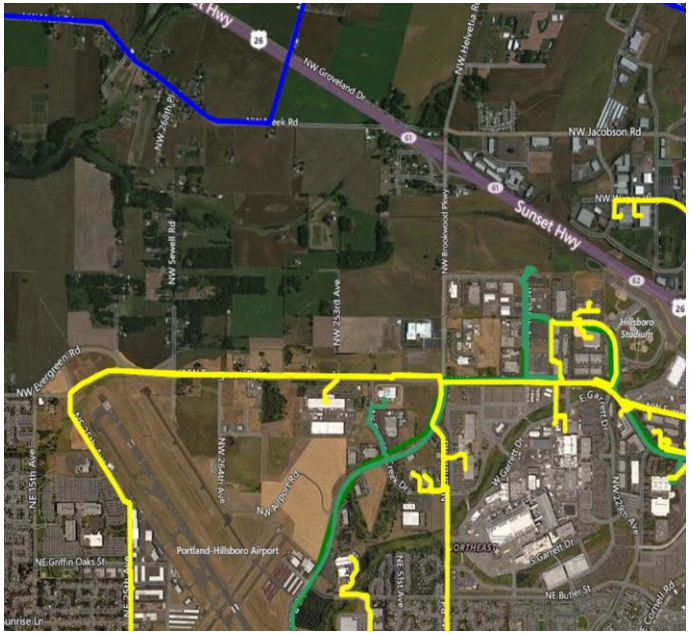
1 Mile Metro Network View

Note: NEF does not have the provider maps for Frontier and Comcast

NW Evergreen Road and West of NE 41st

The infrastructure build-out in the Hillsboro area is centered on the Intel Campus, located just off Hwy 26. This area is where the bulk of existing data center facilities are sited. The area also contains the fiber infrastructure necessary to support data center facilities. Additional fiber extensions, rings and pathways are available further NW and SW; however, the density changes considerably.

The proposed location is situated just south of Hwy 26 off NW Evergreen Road and west of NE 41st Street. Hillsboro's data center cluster, which consists of six data centers, is located 1.5 miles from the recommended site.



NE 41st Street has options for aerial and underground network in a northern and southern direction for diversity. At NW Evergreen Road, the network requires underground buildout, as no aerial structures available. Fiber from the proposed site can traverse into one of the many data centers in Hillsboro, or interconnect into Portland, Oregon. Portland, located less than 30 fiber route miles east, which is less than 1 millisecond away from the area's largest concentration of Internet, Long-haul and network services.

There are nine providers within 1 mile of the proposed location. The providers include: CenturyLink, Comcast, CoastCom by Wave, Frontier (the Local Exchange Carrier), LS Networks, XO, and Zayo (which include the ELI and Integra networks).

Connectivity Options

A review of the telecommunications network infrastructure in the Hillsboro, Oregon area indicates that the long-haul systems supporting the area are centered in Portland. Hillsboro is located approximately 16 miles from Portland proper and included in the larger Portland metropolitan statistical area (MSA).

There is a moderate amount of metro fiber infrastructure supporting Hillsboro. The metro fiber supports local high-tech businesses, approximately six multi-tenant data centers and several private data centers. This same metro fiber infrastructure also supports another eight data centers in Beaverton, Tigard and adjacent areas. Virtually all new data centers in Oregon are locating in Hillsboro – with a few siting locations nearby to connect into Hillsboro's infrastructure.

The metro fiber connects to the long-haul system in downtown Portland at the carrier hotels located at 707 SW Washington Street (Union Bank Building) and 921 SW Washington Street (the Pittock Building.) There are four facilities in downtown Portland that make up most of the intersect points for the metro/long-haul and Internet exchanges.

Most of the fiber in the Hillsboro area runs along the same routes. This is also the case in most metropolitan or higher-density infrastructure areas, as many companies have swapped or purchased fiber from one another.

Metro Fiber Networks

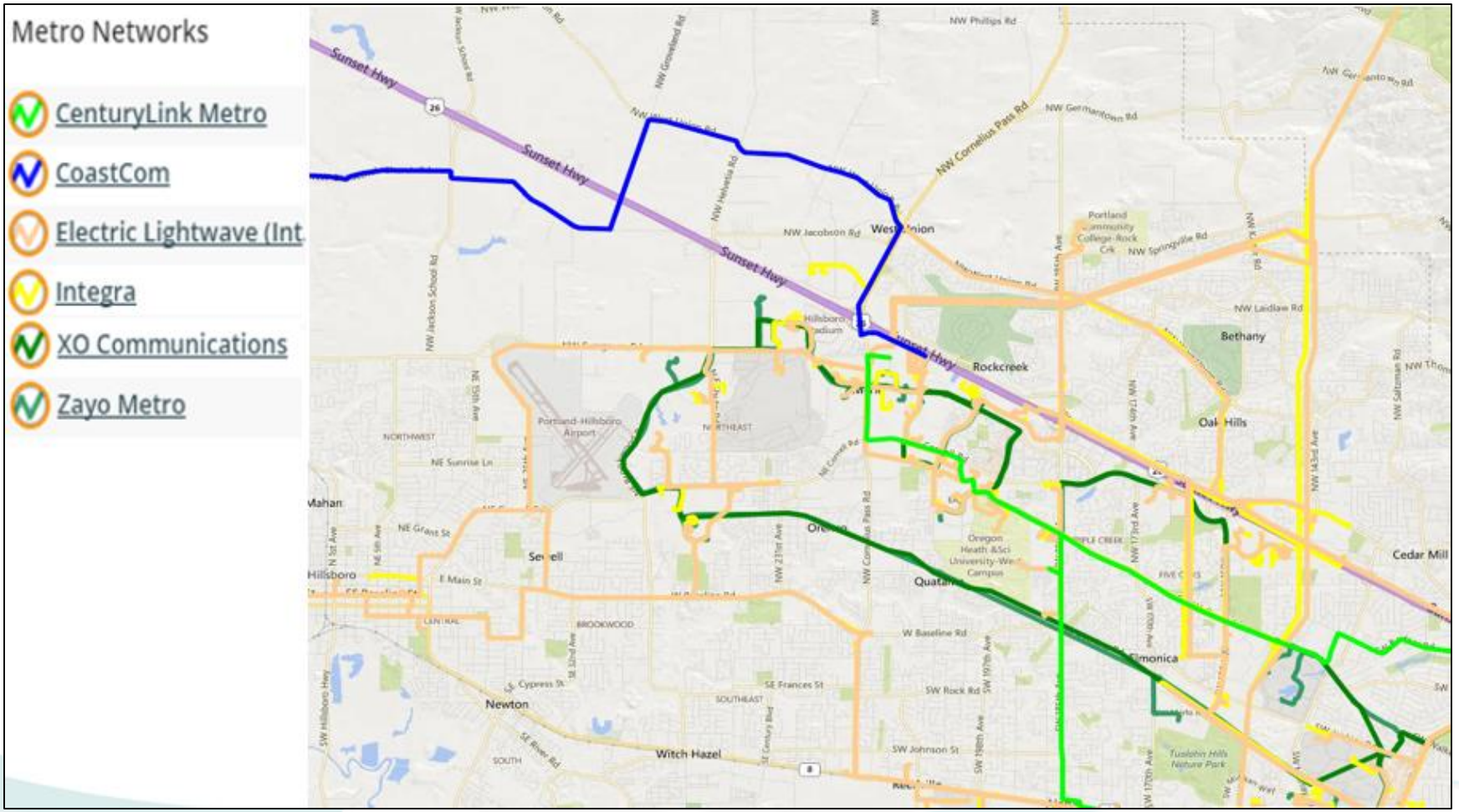
Metro networks can be compared to side streets and roads that support transportation within the town or city. Similar to the road infrastructure, metro networks typically have some type of "on-ramp" to the long-haul network.

This "on-ramp" connection is oftentimes the same hub where the long-haul networks terminate or transition through a given area. Most metro networks are built on customer demand. Many are built in a protected ring fashion, while others are built in a linear fashion to provide services to a single building. Regardless of their design, metro networks are critical in providing the link to long-haul networks and existing data centers in a given area.

There are several metro fiber service providers in Hillsboro. Metro fiber routes include: Comcast, Zayo (which includes Electric Lightwave, and Integra), Time Warner Telecom (Level 3), LS Networks, XO (now Verizon), CoastCom by Wave, CenturyLink and Frontier Communications (the Local Exchange Carrier, former Verizon).

The aforementioned providers are most likely able to provide service to the proposed site, with service including most telecom and data services. In addition, CoastCom by Wave, Silverstar Telecom and Zayo can provide dark fiber.

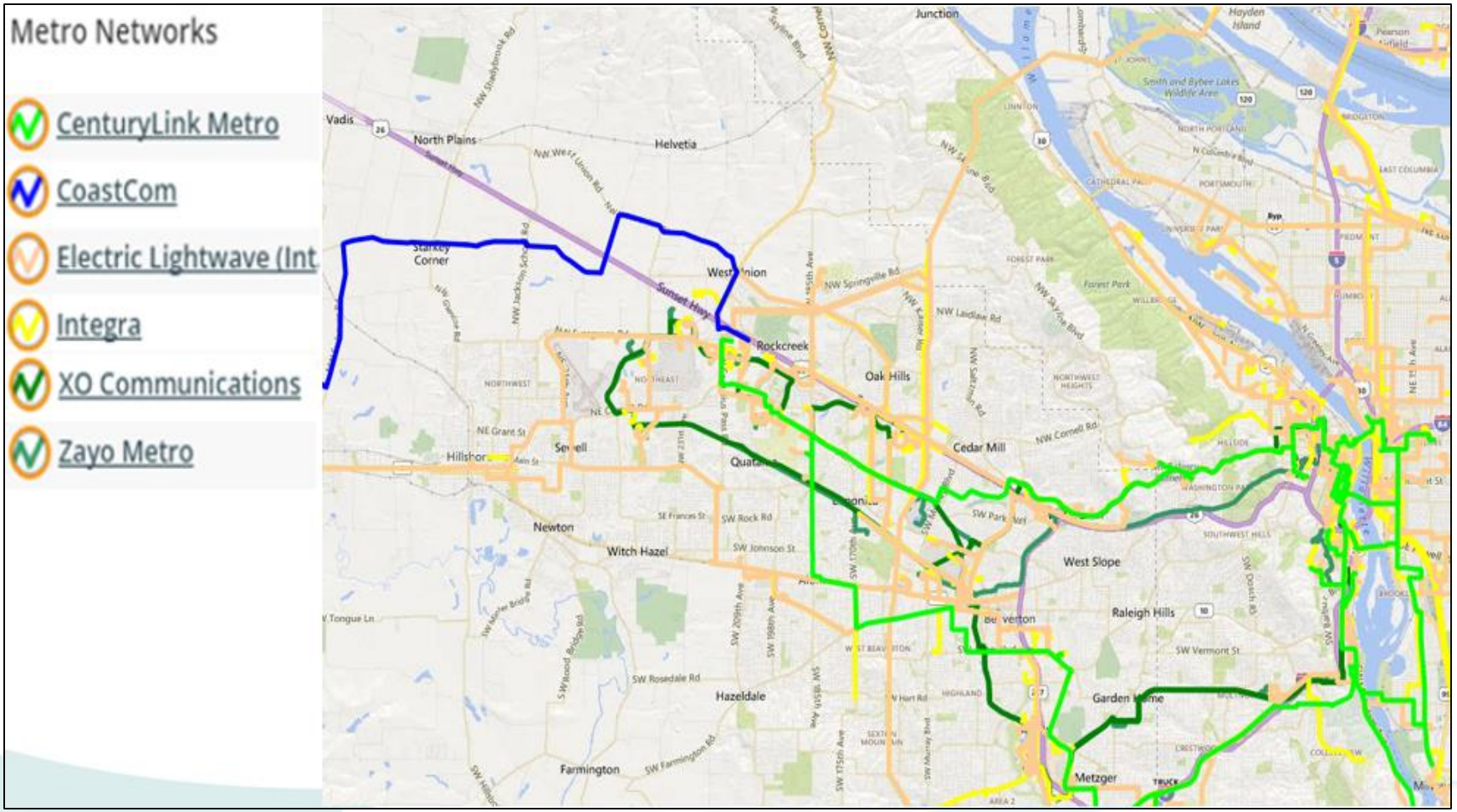
Metro Fiber Networks



5 Mile Metro Network View

Note: NEF does not have maps for all providers in the Hillsboro area.

Metro Fiber Networks



Hillsboro to Portland Metro Networks

Note: NEF does not have maps for all providers in the Hillsboro area.

Sample Pricing

Product	Terms / Months	Monthly Recurring Charge	Non Recurring Charge
Dark – 2 strand Ring	36	$8,500	$6,000
Dark – 2 strand Ring	60	$7,300	$5,000
Dark – 2 strand Ring	12	$6,700	$6,000
Dark – 2 strand Ring	240	$6,100	-
Dark – 2 Point to Point	36	$4,500	$6,000
Dark – 2 Point to Point	60	$3,800	$5,000
Dark – 2 Point to Point	12	$3,500	$6,000
Dark – 2 Point to Point	240	$3,200	-
Dark – 2 Strand Ring	240	$2,400 *	$1,026,984
10G – Wavelength	24	$5,200	$3,000
10G – Wavelength	36	$3,800	-
10G – Wavelength	48	$3,200	-
10G – Wavelength	60	$2,800	-

*Estimated Operational and Maintenance Charges

Sample of pricing for dark fiber and 10Gb services from Hillsboro to Portland.
NEF offers full brokerage services if requested for connectivity.

Data Centers and Internet Exchanges

Several data centers have recently opened in Hillsboro, just south of Hwy 26. Oregon's relatively low power costs, moderate temperatures and tax incentives make the state an attractive home for data centers. With no sales tax, a business can see potential cost savings. The business tax rate is one of the lowest in the country, and Hillsboro offers business tax incentives that make doing business in Oregon an easy choice. In the past few years, companies such as Adobe, EdgeConnex, LinkedIn and NetApp have opened data centers in Hillsboro. Additionally, in 2015 ViaWest and T5 expanded their presence in Hillsboro. What's more, Hillsboro is often referred to as Silicon Forest, due to the high concentration of technology companies.

There are seven Internet exchange point's (IX or IXP) in and around Hillsboro. An Internet exchange point is a physical infrastructure through which Internet service providers (ISPs) and Content Delivery Networks (CDNs) exchange Internet traffic between their networks (autonomous systems).

Hillsboro Data Centers

1. 23605 NW Huffman Street, Hillsboro – Via West(Brookwood)
2. 23245 NW Evergreen Pkwy, Hillsboro – EdgeConnex
3. 21515 NW Evergreen Pkwy, Hillsboro – Fortune | Infomart
4. 21101 NW Evergreen Pkwy, Hillsboro – Tata Communications
5. 3825 NW Aloclek Place, Hillsboro – Telx
6. 3935 NW Aloclek Place, Hillsboro – ViaWest

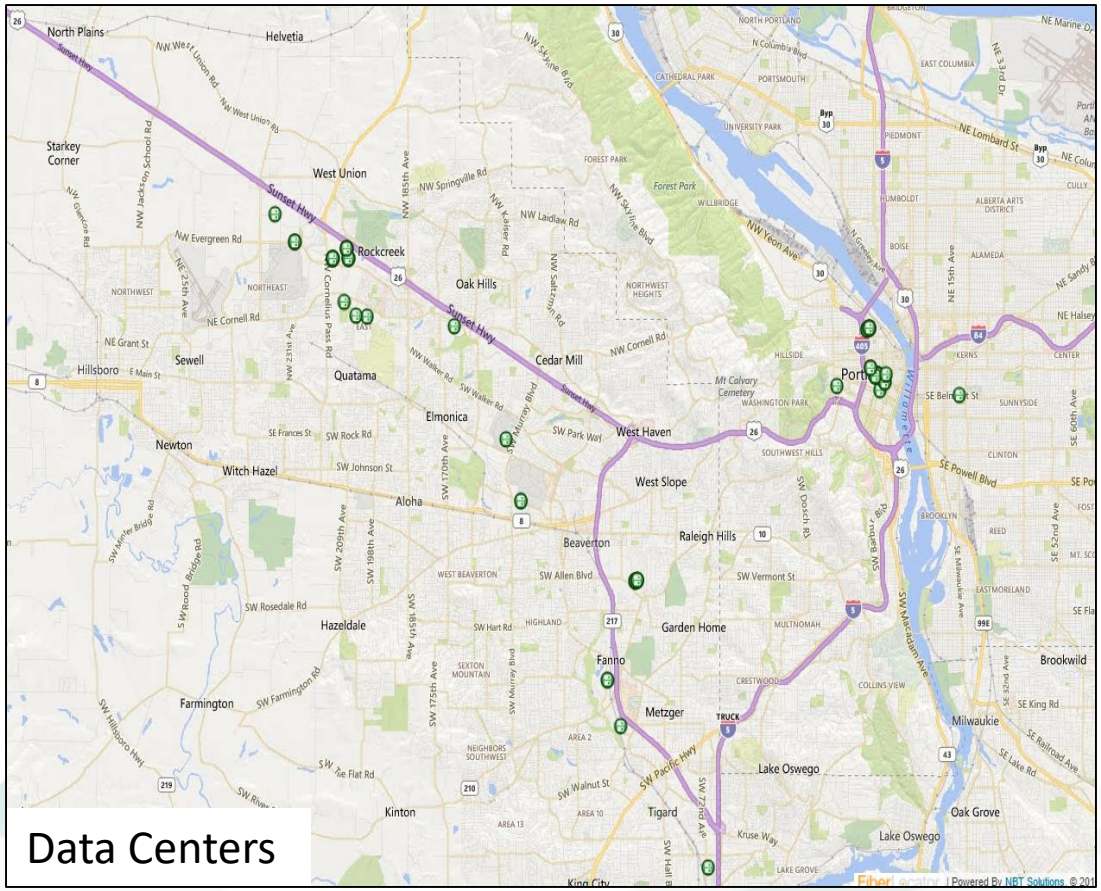
Hillsboro Area IXP's

1. 21515 NW Evergreen Parkway, Hillsboro
2. 23245 NW Evergreen Parkway, Hillsboro
3. 3935 NW Aloclek Place, Hillsboro
4. 9705 SW Sunshine Court, Beaverton
5. 921 SW Washington Street, Portland
6. 625 SW Stark Street, Portland
7. 1225 W Burnside St, Portland

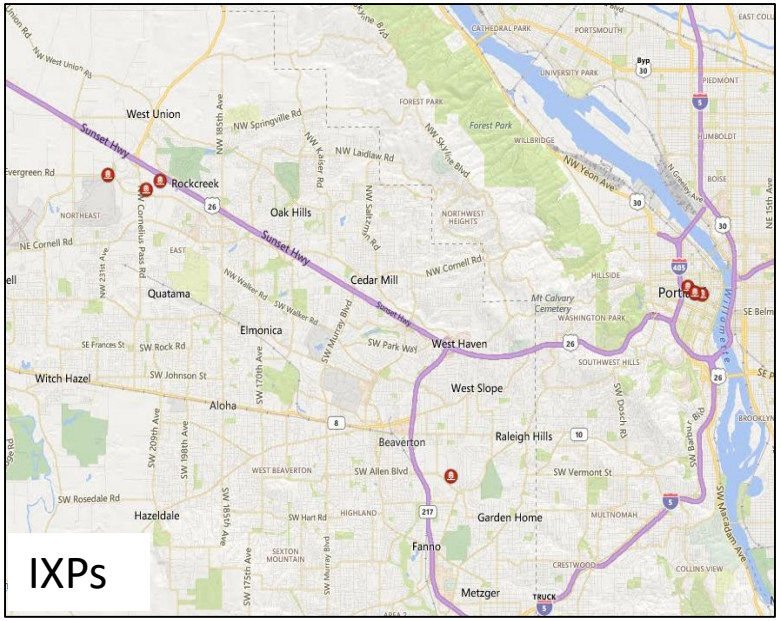
Portland Carrier Hotel Location

921 SW Washington, Portland, OR

Data Center and IXP Map



Data Centers



IXPs

NEF

Long-Haul Networks

Long-haul networks are fiber optic based networks that provide a standardized method of transporting traffic from state-to-state and city-to-city. They can be visualized like the highway system that criss-crosses the United States. In relationship to data centers, long-haul networks are the key backbone for transporting data and voice services, as they "mesh" with the local metro networks to ensure traffic is successfully delivered. These networks connect to a central "hub" facility (data center) in a given city and exit the city in another direction.

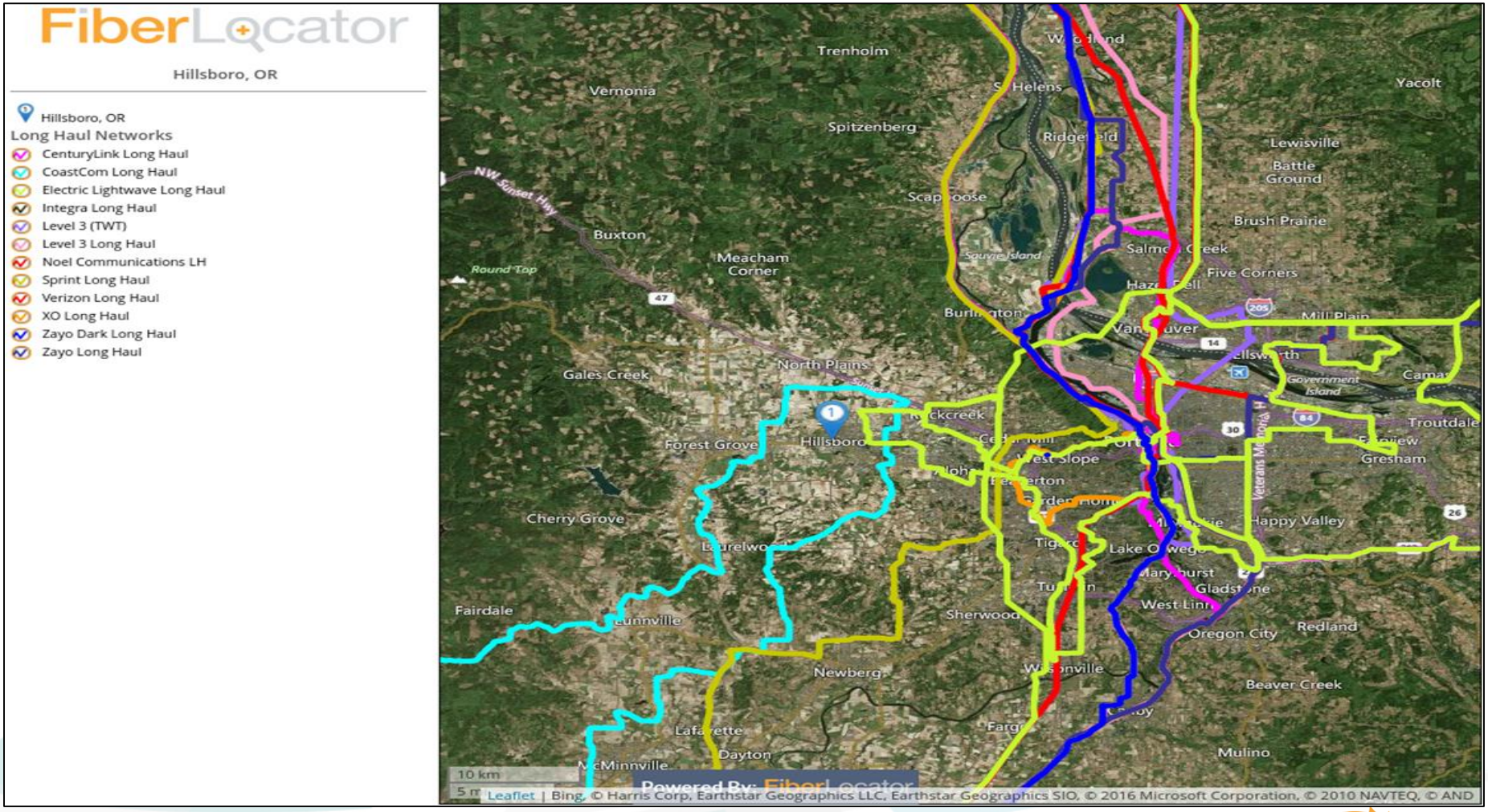
These high-density centers in data centers link long-haul fiber routes to the metropolitan fiber infrastructure. From Portland to Hillsboro there are several service providers making Hillsboro well connected among the long-haul systems.

The presence of diverse infrastructure pathways, or routes, is a key element in the creation of high-reliability networks. For instance, with two paths or routes, data can travel along one route if the other route were to fail. In Portland, there are over 10 long-haul fiber routes, excluding interregional routes that can be used for augmentation. Additionally, Hillsboro has four long-haul fiber routes. Altogether, having long-haul, carrier hotel and metro fiber density ensures that virtually any telecommunication service can be obtained and maintained at the highest level possible.

Main Junction Points

1. 921 SW Washington, Portland, OR
2. 707 SW Washington, Portland, OR
3. 23605 NW Huffman St, Hillsboro, OR
4. 21515 NW Evergreen Pkwy, Hillsboro, OR

Long-Haul Networks



Submarine Cables

Submarine Cable Stations

Hillsboro is a key area for the north/south and east/west transit lines that serve the world. Three trans-Pacific cable landing stations terminate in Hillsboro, supplying data connectivity and capacity between Asia and the Pacific Coast, and beyond (TGN Pacific, TPE Hillsboro, and Southern Cross-North Star Alaska). Two additional trans-Pacific cable landing stations, New Cross Pacific (NCP) and Hawaiki Cable will also terminate in Hillsboro.

TGN-Pacific is located at 21101 NW Evergreen Parkway in Hillsboro, about 150 miles away from Nedonna Beach's S1 cable landing sites and Rockaway Beach's S5 cable. Tata Communications provides the backhaul for this site back to the West Coast.

TPE Hillsboro is located at 2550 NW Aloclek Drive. Verizon Business offers colocation service here for the TPE consortium members. AT&T, China Telecom and KT operate their colocations in the TPE terminal station. Level3, XO and Level 3 (tw telecom) can provide backhaul reaching the manholes outside the terminal station.

The third landing station at 19720 NW Tanasbourne Drive in Hillsboro is the **Southern Cross – NorthStar Alaska**. This has the Southern Crossing cable network and Northstar Alaska cable system. Many providers such as Zayo, Verizon Business, Level 3, XO and Alaska Communications provide backhaul for this station.

New Cross Pacific (NCP) Consortium secured a cable landing license from the FCC in January 2017. The Consortium consists of Microsoft, China Mobile, China Telecommunications, China United Network, Chunghwa Telecom, KT Corporation and Softbank.

Hawaiki Cable spans 14,000 km, linking Australia, New Zealand, American Samoa, Pacific Island, Hawaii, and Oregon, on the US West Coast. It will deliver more than 30 Tbps of capacity and will be the fastest and largest link between the US and Australia and New Zealand. The cable system is expected to be ready for service in June 2018.

Service Provider Matrix

Provider	Products	Dark Fiber	Contact	Phone	email
Alaska Communications	Voice, data and internet	No	Chantal Pascual	907-564-1968	Chantal.pascual@acsalaska.com
Centurylink	Voice, data and internet	No	Trevor Burnside	801-790-4901	tburnside@telarus.com
CoastCom by Wave	Voice, data and internet	Yes	Fred Miller	360-543-5200	fmiller@wavebroadband.com
Cogent	Data and internet	No	Billy Glover	814-203-6144	bglover@cogentco.com
Comcast	Voice, data and internet, TV	No	Bill Reumann	860-505-2064	william_reumannjr@cable.comcast.com
Frontier	Voice, data and internet, TV	No	Marianne Broughton	952-435-1678	Marianne.broughton@ftr.com
Freewire	Fixed wireless	No	Chris Scalera	503-270-5505	chriss@gofreewire.com
Level 3	Data and internet	No	Jay Dacey	518-640-0902	James.dacey@level3.com
LS Networks	Voice, data and internet	No	Bob Schmitz	503-414-0479	bschmitz@lsnetworks.com
SilverStar Telecom	Voice, data and internet	Yes	Clint Warta	360-859-4450	clint@silverstartelecom.com
TATA communications	Voice, data and internet	No	Matthew David	949-201-9292	Matthew.david@tatacommunications.com
XO & Verizon	Voice, data and internet	No	Kevin Francis	801-983-1641	kevin.t.francis@xo.com
*Zayo	Data and internet	Yes	Sheree Hamway	973-513-9383	Sheree.Hamway@zayo.com

*Zayo incudes Electric Lightwave and Integra